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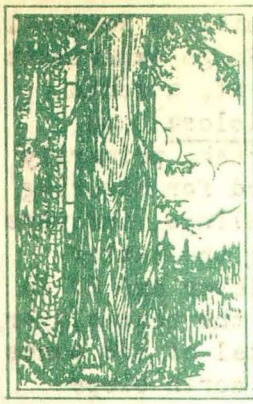

FOREST RESEARCH NOTES

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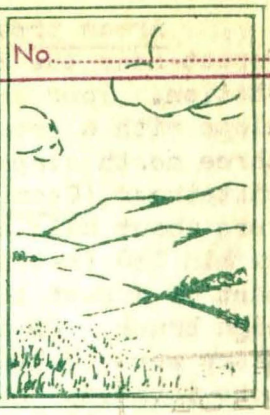

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SITE PREPARATION AS AN AID TO SUGAR PINE REGENERATION[1/]

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On many thousands of acres of cut-over timber lands in California, brush of various species has gained such control of the soil that the success of natural reproduction is problematical. This condition is particularly serious in the high site quality sugar pine-white fir and sugar pine-ponderosa pine types,[2/] where the maintenance of sugar pine in the stands is a silvicultural objective. Observations have indicated that sugar pine seedlings are not able to compete successfully enough with established brush to insure a desirable stand. To take advantage of the infrequent heavy sugar pine seed crops, it appears that brush competition should be removed to increase the chances of natural reproduction. This study was designed, therefore, (1) to determine whether clearing the brush from unstocked areas during a good sugar pine seed year would foster natural regeneration of sugar pine, (2) incidentally to compare the effectiveness of three methods of establishing reproduction: natural seeding, seed spotting, and planting on the cleared areas.

1/ Grateful acknowledgment is made to E. A. Morrow, California Forest and Range Experiment Station, who directed site preparation, and to Duncan Dunning, California Forest and Range Experiment Station, who reviewed the plans and results of the study.

2/ Sugar pine, Pinus lambertiana; ponderosa pine, P. ponderosa; white fir, Abies concolor.

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Procedure

Areas treated.- The study was conducted on the Stanislaus National Forest near the Stanislaus Branch, California Forest and Range Experiment Station. Four general locations were selected for treatment, a south slope with a ground cover of bear-clover (Chamaebatia foliolosa) and three north slope locations with a ground cover of high brush, primarily whitethorn (Ceanothus cordulatus). Specific areas selected for clearing were about half a chain square, were not stocked with seedlings, and were within 150 feet of a bearing sugar pine seed tree. During the latter part of August 1941, 17 such areas were cleared in bear-clover and 20 in high brush. On the south slope, surrounding the plots in the bear-clover, there were 13 bearing sugar pine seed trees on which a total of 458 cones were counted. Surrounding the plots in high brush on the north slope there were 19 bearing trees on which 1,419 cones were counted. In comparison to cone crops observed over a period of years, this crop would be classed as heavy.

Clearing.- The brush was removed by means of a 20 h.p. tractor equipped with a toothed blade designed by the Division of Plant Disease Control[3/] to eradicate concentrated Ribes. In high brush the rooting out of a few clumps often cleared the entire area. In bear-clover, however, it was necessary to cover the area in two directions, at right angles to each other. After the brush was removed, the tractor was backed across with the blade lowered to level the soil. The tractor driver was assisted by a helper who located hidden stumps, logs, and boulders, and cleaned brush from the teeth of the blade. An average of about 30 minutes was required to strip the brush from each area. A tractor with more power and a blade with teeth spaced farther apart so that dirt would not pile up would have decreased the time considerably.

Plot design.- In each of th 37 cleared areas a plot 24 feet square was laid out. Each plot was divided into 64 quadrats, 3 feet square, 4 of which were designated for sampling seed supply, 16 for natural reproduction, 16 for seed spotting, and 16 for planting. The remaining 12 quadrats were available for shifting any of the natural, seed-spot, or planting quadrats to avoid rocks or stumps.

Sampling seed supply.- Four seed traps, 2.86 feet square inside dimension, were placed in each plot during the first part of September to sample the seed fall on the plots.

Natural reproduction.- Quadrats reserved for sampling natural reproduction were disturbed as little as possible during the process of seed sampling and planting.

Seed spotting.- On November 12, 1941, five seeds were planted about one-half inch deep in each of the 16 seed-spot quadrats per plot. Each seed spot was covered with a conical hardware cloth rodent screen set about 2 inches into the soil. The seed was a local lot that had just been collected.

3/ Offord, H. R., J, F. Beakey, and L. P. Winslow. The eradication of upland Ribes by power equipment. Division of Plant Disease Control, Bureau of Entomology and Plant Quarantine, Berkeley, California, March 12, 1940. (Office report, typewritten.)

Planting.- A sugar pine 1-1 transplant was planted on November 12, 1941, by the side-hole method in each of the 16 quadrats of each plot. The stock was obtained from the Feather River nursery a few days prior to planting.

Results

Seed supply.- In November 1941, there were on an average, 1.4 good sugar pine seeds per trap in the bear-clover plots and 2.6 good seeds per trap in the high brush plots. On the basis of this sample, it might be expected that about 70 percent of the natural reproduction quadrats would have received one or more good sugar pine seeds.

Natural seedlings.- During the spring and summer of 1942, only 17 natural seedlings germinated in 14 of the 592 natural reproduction quadrats of the 37 plots. Only 5 seedlings were alive at the end of the first season. Natural reproduction thus was practically a failure.

Seed spots.- In the first season one or more seedlings germinated in 92 percent of the seed spots. In 27 percent of the spots, all 5 seeds germinated. On the basis of total number of seeds planted, the rate of germination was 68 percent.

The percent of seed spots stocked, the average number of seedlings per stocked spot, and the average height of the tallest seedling per spot are given in table 1 for the first 3 years of the study.

Table 1.- Survival and height of seedlings in seed spots on cleared sites

Former cover	Stocked seed spots			Seedlings per stocked seed spot			Height[1] of tallest seedling per spot	
	1942	1943	1944	1942	1943	1944	1943	1944
	Percent	Percent	Percent				Inches	Inches
Bear-clover	59	21	15	2.9	2.0	1.8	1.7	2.2
High brush	87	75	67	3.1	2.8	2.7	2.6	3.6

1/ Height measured from cotyledon scar.

Planted stock.- Survival and height of the planted trees are given in table 2.

Table 2.- Survival and height of planted stock on cleared sites

Former cover	Survival			Height[1/]	
	1942	1943	1944	1943	1944
	Percent	Percent	Percent	Inches	Inches
Bear-clover	58	38	34	4.7	5.4
High brush	47	45	41	5.1	6.6

1/ Height measured from the cotyledon scar.

Discussion

It is obvious that, in spite of a heavy seed crop, natural reproduction was practically a failure. The failure was probably the result of rodent depredations. Clearing of the small areas very likely provided a very good opportunity for rodents to find the large sugar pine seeds. Site preparation to take full advantage of seed crops should be accompanied by thorough rodent control.

In the area cleared of high brush, seed spotting was more effective than planting. In the bear-clover area, however, planting was more effective. This might be explained by the fact that the bear-clover sprouted back so quickly that by the second season it had overtopped the seedlings. The planted stock, being several inches taller, was not so completely dominated.

After 3 years very little of the high brush species has sprouted back or has grown from seed in the cleared areas. It appears quite probable that the sugar pine from the seeding and planting will become established in these before the brush can regain control.

Summary

The brush cover of bear-clover or high brush was removed mechanically from 37 unstocked areas in cut-over stands in anticipation of a good sugar pine seed crop. In the cleared areas, plots were established to determine whether natural seedlings would result and to compare the effectiveness of natural reproduction, seed spotting under screens, and planting.

In spite of a good seed fall, natural reproduction was a failure, probably because of rodent depredations.

After 3 years, seed spotting was less effective than planting in areas cleared in bear-clover but was more effective than planting in areas cleared in high brush. A fair percentage of the sugar pine from seed and planting survived and grew well through the third season, indicating possibilities of successful establishment before brush regains control.